

# Five Mile Slough and Five Mile Creek

## Project Study Report

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## Introduction

The purpose of this study is to investigate how Five Mile Slough and Five Mile Creek is intended to function and how it is currently functioning, what maintenance is being performed and what maintenance should be performed, who is responsible for the maintenance, what can be done to improve the function of Five Mile Slough and Five Mile Creek, and what permitting is required to make any improvements. The study will also identify potential rehabilitation methods as well as cost ranges for potential permitting, environmental requirements, and rehabilitation methods. The scope of the study is limited to the waterway from Pacific Avenue to Five Mile Dam and does not include engineering design, engineering feasibility analyses, or creating a water quality and/or water elevation monitoring plan.

Five Mile Slough and Five Mile Creek generally consist of an approximate 2.7 mile waterway starting near the intersection of Pacific Avenue and Rivera Road and terminating at Fourteen Mile Slough near Hatchers Circle in the North Lake residential subdivision (Refer to Figure 1, below). Five Mile Slough is also sometimes referred to as Five Mile Creek, however, based on maps by the United States Geological Survey (USGS), Five Mile Slough is the waterway between Fourteen Mile Slough and Alexandria Place, while Five Mile Creek is the waterway between Pacific Avenue and Alexandria Place (USGS 1953; USGS and DWR 1968a; USGS and DWR 1976a; USGS 2015a). This is consistent with the definition of a slough and a creek:

***“A slough is a swamp or shallow lake system, usually backwater to a larger body of water” (NOAA 2017), whereas a creek is a natural stream that is usually smaller than and tributary to a river.***

Figure 1. Geographical extent of Five Mile Slough and Five Mile Creek.



From Pacific Avenue, Five Mile Creek meanders through Lincoln Village to Alexandria Place, passing underneath bridges on private property and through culverts on Caran Avenue, Pershing Avenue, and Alexandria Place. Continuing as Five Mile Slough, the waterway then straightens, flows next to Swenson Golf Course, and passes through culverts on Plymouth Road and Interstate Route 5. Water in the creek and the slough consist primarily of stormwater runoff from a roughly 1,548 acre watershed area. At the

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outlet of Five Mile Slough, Five Mile Dam regulates the water level within the slough and the creek, keeping the water level higher in the summer and lower in the winter (Siegfried 1976; 10 Oct. 2017 meeting with San Joaquin County).

In its history, Five Mile Slough and Five Mile Creek's natural watercourse and function has been altered due to channel straightening and levee construction in the late 1800's and early 1900's, removal of tributary streams, construction of the roadway crossings, and increased peak flows from urbanization from the 1950's to the present<sup>1</sup>. Since the 1990's, residents and Reclamation District 1608 have notified through letters and public outreach meetings to both the City of Stockton and San Joaquin County about systemic issues with flooding, stagnant water, declining water quality, invasive aquatic weeds, a deteriorating ecosystem, boat navigability, lack of maintenance, and trespassing within both Five Mile Slough and Five Mile Creek (Pulver 1998; Giottonini; Allen 2000; Lewis 2002; Stovall 2002; 16 Nov. 2017 public outreach meeting at Mable Barron). Many of these issues are interrelated, requiring a coordinated response by responsible parties to implement multiple solutions to address the issues simultaneously to prevent the problems from reoccurring, avoid creating new problems, and avoid making other issues worse. Efforts to improve the waterway and mitigate and remove aquatic weeds have been difficult due to the private ownership of Five Mile Slough and Five Mile Creek amongst residents, and a lack of funding mechanisms (Pulver 1998; Moe 1984; Allen 2000; Stovall 2002; Lewis 2002).

The watershed area and the scope of the study are presented in Exhibit 1. This report presents a timeline of the alterations to Five Mile Slough and Five Mile Creek and their tributary areas, as well as a history of the rehabilitation efforts. A background of Five Mile Slough's and Five Mile Creek's hydrology, hydraulics, water quality, and ecology is provided, along with their implications on rehabilitation efforts. This report also identifies the jurisdictions encompassing Five Mile Slough and Five Mile Creek, as well as agency and stakeholder responsibilities and environmental compliance requirements. Lastly, a list of potential future actions, as well as their approximate cost ranges and implementation timelines, are described.

## History

### 1894 to 1952

Historical records documenting the Five Mile Slough and Five Mile Creek watershed in the early 1900's are limited. Refer to the USGS topographic maps shown in Figure 2 and Figure 3 below. Five Mile Slough and Five Mile Creek were named after Five Mile House, which existed near the present-day Five Mile House Apartments. Between 1894 and 1907, an earthen dam was constructed on Five Mile Slough at the present-day location of Five Mile Dam, and the channels were straightened so that the water could be used for agricultural irrigation (USGS 1910; Pulver 1998). The construction of the dam effectively disconnected Five Mile Slough from Fourteen Mile Slough, removing Five Mile Creek and Five Mile Slough's natural outlet, and created a water body that does not flow like a river.

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<sup>1</sup> USGS 1953; USGS and DWR 1968a; USGS and DWR 1976a; Pulver 1998; City of Stockton 1987 and 2017; Siegfried 1963, 1976, 1979, 1981, and 1991; Mark Thomas and Company 2016

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Figure 2. 1898 topographic map of the Five Mile Slough and Five Mile Creek watershed showing the historic Castle area surveyed in 1894 with the historic Five Mile Creek denoted below with a red rectangle. The map shows that prior to the time the earth fill was constructed at the present-day location of Five Mile Dam, Five Mile Creek appears to meander and flow like a creek downstream of the present-day location of Alexandria Place. It is not yet known whether this portion of Five Mile Creek is the same as the present-day Fourteen Mile Slough downstream of Five Mile Dam, and where it ultimately discharged to. The map shows there was little to no development at this time (USGS 1898).

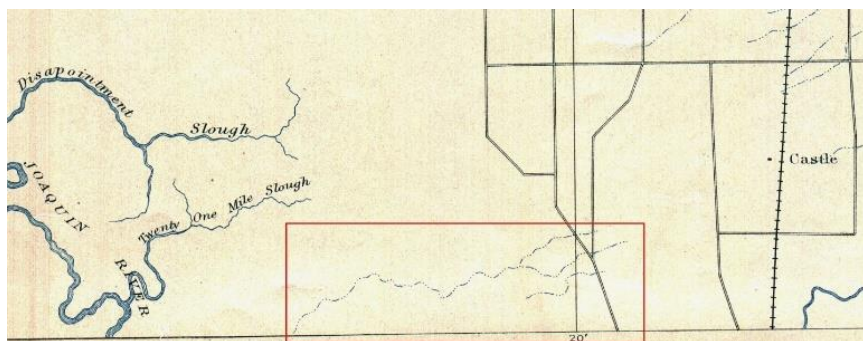


Figure 3. 1910-1913 topographic map of the Five Mile Creek and Five Mile Slough watershed (USGS 1910; USGS 1913). The map shows that Five Mile Creek was straightened, levees were constructed, and an earth fill was installed at the present-day location of Five Mile Dam so that Five Mile Slough could be used for irrigation (Pulver 1998).



#### 1952 to 1968

Between 1952 and 1968, most of the Five Mile Slough and Five Mile Creek watershed was developed (Refer to Figure 4 and Figure 5, below). In the 1950's, Lincoln Village and Parkwoods were developed (USGS 1953). In 1952, Swenson Park Golf Course opened (City of Stockton 2017), and in 1954, Lincoln High School opened (Lincoln Unified School District 2017). Between 1958 and 1959, there were concerns

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about flooding in Five Mile Slough due to increased runoff from development (Pulver 1998). In 1959, the Pacific Avenue pump station was constructed to drain the area north of Lincoln Road as well as an area on the north side of Hammer Lane on both sides of Lower Sacramento Road; this pump station was expanded in 1965 to drain the Carson Ranch area (Siegfried 1979). Around 1963, Breuner's Home Furnishings was developed near the intersection of Pacific Avenue and Hammer Lane (Siegfried 1963), resulting in Five Mile Creek upstream of Pacific Avenue being converted into a ditch along Hammer Lane. Interstate Route 5 began construction between 1965 and 1968, which included a box culvert at the crossing over Five Mile Slough (Pulver 1998; USGS and DWR 1968a). Residents protested the construction of the box culvert over concerns that it would restrict boating, but the box culvert was constructed as planned since Five Mile Slough was considered a non-navigable waterway (Pulver 1998). By 1968, most of the watershed between Swenson Golf Course and Western Pacific Railroad had been developed (USGS and DWR 1968a).

Figure 4. 1952-1953 topographic map of the Five Mile Creek and Five Mile Slough watershed, published by the United States Geological Survey. The vicinity was surveyed in 1952 and 1953. The map shows the beginning of the development of Lincoln Village and the addition of Swenson Golf Course.



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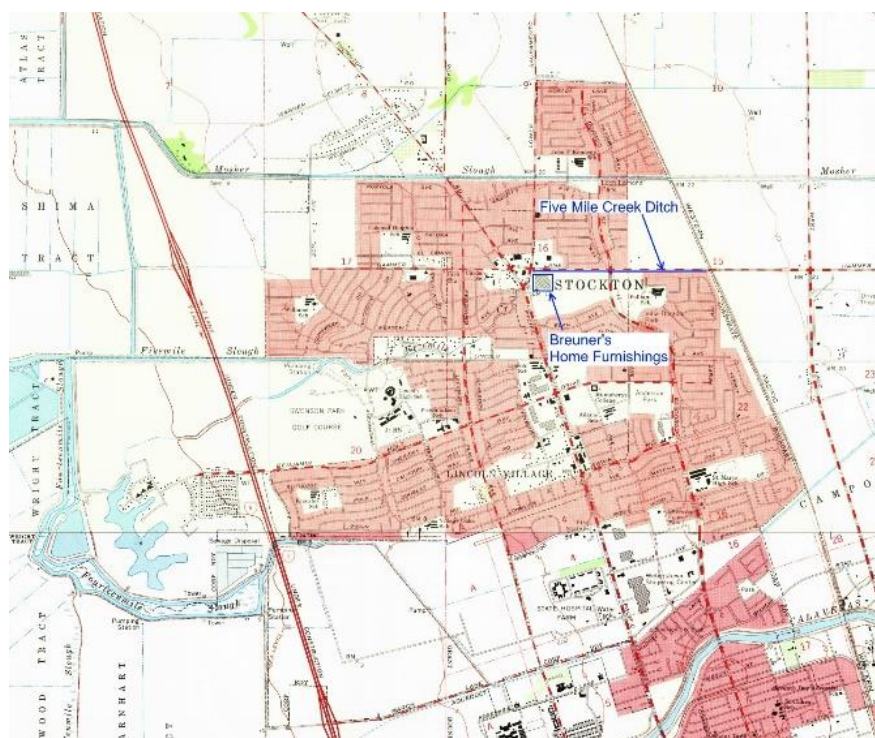
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Figure 5. 1968 topographic map of the Five Mile Creek and Five Mile Slough watershed from maps published jointly by the United States Geological Survey and California Department of Water Resources. The vicinity was surveyed in 1967. Most of the watershed has been developed—the map shows the remainder of the development of Lincoln Village and the development of Parkwoods, which removed the north tributary from Five Mile Creek. The development of Breuner's Home Furnishings store around 1963 resulted in Five Mile Creek being converted into a ditch along Hammer Lane upstream of Pacific Avenue (Siegfried 1963). Interstate 5 began construction between 1965 and 1968 (Pulver 1998; USGS and DWR 1968a; 1968b).



#### 1968 to 1991

From 1968 to 1990, the watershed continued to develop, and flooding became more of a problem in Five Mile Slough and Five Mile Creek (Refer to Figure 5, as well as Figure 6, and Figure 7, below). Between 1968 and 1976, Lincoln Village West was developed (USGS and DWR 1968a; USGS and DWR 1976a). The Landing, along with the Lighthouse Pump station, was developed around 1981 (Siegfried 1981). In 1979, R.W. Siegfried and Associates prepared a drainage study for Five Mile Slough and Five Mile Creek to evaluate the required capacity of a proposed storm water trunk main on Hammer Lane from El Dorado Street to Pacific Avenue. The study found that Five Mile Creek could not hold the increased drainage from the proposed storm water main without improvements to the culvert at Caran Avenue and reshaping the creek to lower the water depth. According to a response to the study by the City of Stockton, the creek improvements were infeasible due to resistance to widening the creek from property owners (Moe 1984). In 1987, a third culvert was constructed at Alexandria Place to improve the hydraulic capacity of the crossing (City of Stockton 1987). In 1991, the City approved a Specific Plan to widen Hammer Lane

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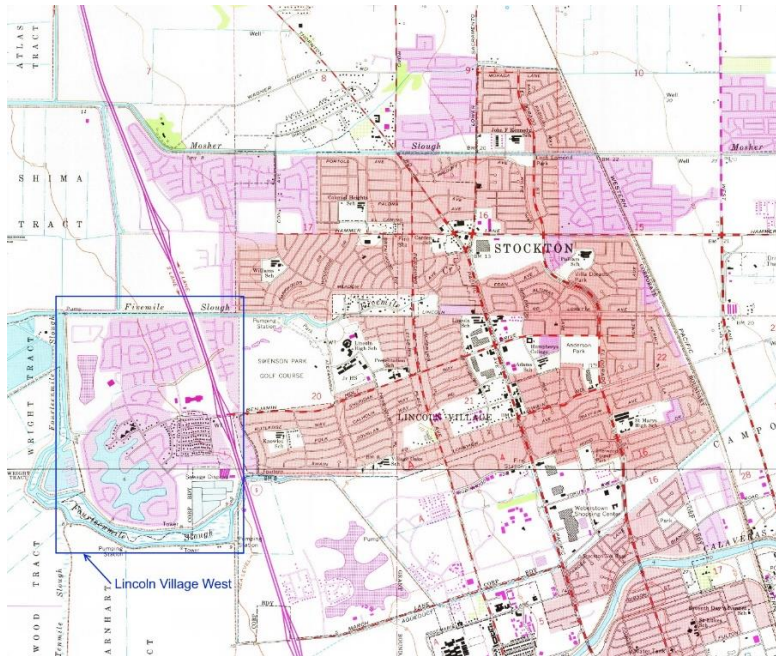
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that involved diverting a portion of the upstream runoff to Mosher Slough through a storm drain main on Hammer Lane and El Dorado Street. The project was completed in 2002.

Figure 6. 1976 topographic map of the Five Mile Creek and Five Mile Slough watershed published jointly by the United States Geological Survey and California Department of Water Resources. Lincoln Village West was developed, which removed the southern fork from Five Mile Creek.



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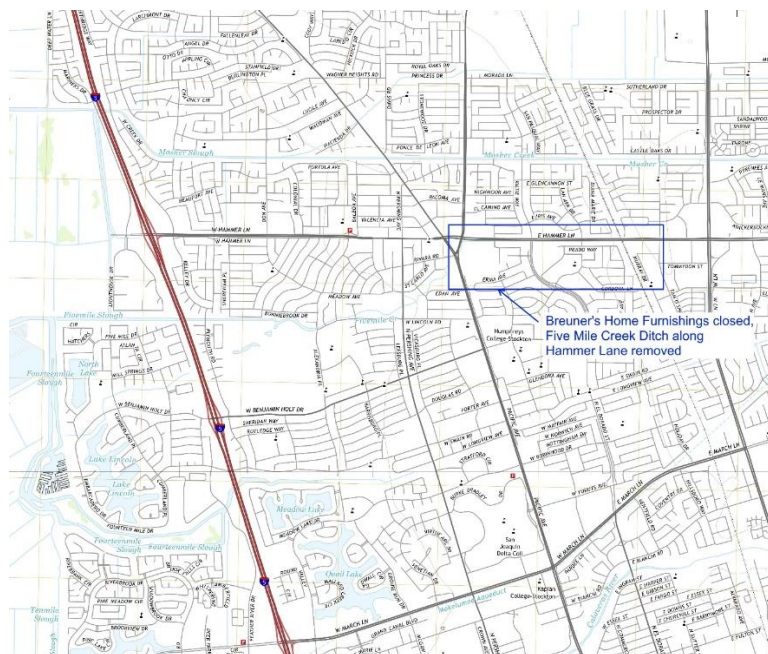
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Figure 7. 2015 topographic map of the Five Mile Creek and Five Mile Slough watershed published by the United States Geological Survey. Contours are from 2005, the vicinity was surveyed in 2011 and hydrography data is from 2012. The Landing was developed around 1981 (Siegfried 1981). Around 2002, Breuner's Home Furnishings closed, the ditch along Hammer Lane was removed, and the flow upstream was re-routed to Mosher Creek (Siegfried 1991; USGS 2002 imagery in Google Earth 2017).



### 1991 to Present

As open land became scarce and development within the Five Mile Slough watershed decreased, residents raised awareness about problems with flow and water quality in Five Mile Slough and Five Mile Creek, documented in letters and memorandums by stakeholders. In 1997 a resident living on Caran Avenue reported root and stability damage to heritage oak trees on his property from flooding in Five Mile Creek (Allen 2000). This resulted in a public meeting held in 1998 for residents along Five Mile Slough and Five Mile Creek to express their concerns and for stakeholders to discuss possible solutions (Allen 2000; Pulver 1998). Residents reported different problems in different parts of the waterway, and City and County officials could not determine if the complaints were about too much water or not enough water. Residents living adjacent to Five Mile Slough raised awareness about stagnant water, sediment deposition, and lack of continuous flow; residents adjacent to Five Mile Creek downstream of Pershing Avenue raised awareness about stagnant water and problems with duckweed; and residents adjacent to Five Mile Creek upstream of Pershing Avenue raised awareness about stagnant water, lack of continuous flow, and flow restrictions (Allen 2000). A 1999 letter to City Mayor G.A. Podesto from City Public Works proposed dredging to the bottom of the buried Alexandria Place culvert, removing 2.5 feet of silt along 2,000 feet of Five Mile Slough between Hazelwood Avenue and Alexandria Place and adding riprap to the stormwater pump station outfalls (Giottonini 1999), but the work was not approved.

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In 2002, residents raised awareness to both the City and the County about water hyacinth (Refer to Figure 8, below), and J. Stovall, an attorney representing Reclamation District 1608, sent a letter to the County requesting that the County remove the water hyacinth due to the concern that the water hyacinth could block Five Mile Dam and/or the roadway culverts, resulting in flooding through Swenson Golf Course into the District (Stovall 2002). In an April 12, 2002 staff report to the City Mayor and City Council, the City Manager proposed a combination of aquatic herbicides and physical removal of water hyacinth. The report stated that in addition to getting the necessary permits to spray herbicides, it would also require getting permission from each property owner, private, City, County, or Reclamation District 1608, that own portions of Five Mile Creek and Five Mile Slough to spray and physically remove water hyacinth (Lewis 2002). The report expressed concerns that sprayed plants would sink to the bottom, which would not resolve the aesthetic impacts due to the shallow depth, and would also decay and deplete the dissolved oxygen in the stream, which was recently added to 303(d) list of impaired water bodies for low dissolved oxygen (Lewis 2002; SWRCB 2002). The San Joaquin Area Flood Control Agency prepared and implemented a California Environmental Quality Act (CEQA) Initial Study and Mitigated Negative Declaration for an aquatic weed control program (Kleinschmidt & Associates 2003; Giottonini 2003). To date, however, water hyacinth and other aquatic weeds remain a problem (16 Nov. 2017 public outreach meeting at Mable Barron).

There has been historical jurisdictional lack of coordination between the City, the County, and the Reclamation District 1608 over who is responsible for investigating problems with the slough and the creek, as well as who is responsible for maintenance. A summary of the City's, County's, and Reclamation District's positions is provided in Table 1 below.

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Figure 8. Water hyacinth in Five Mile Slough at Plymouth Road at the downstream culverts and upstream of the culverts, taken in September 2017. Water hyacinth is visible from bank to bank, showing its tendency to grow uncontrolled. Current control efforts have included spraying and physical removal, but it has only provided temporary control (Lewis 2002; Kleinschmidt & Huffman 2003; 16 Nov. 2017 public outreach meeting at Mable Barron).



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Table 1. Summary of agency positions on investigative and maintenance responsibilities.

	<b>City of Stockton's Position</b>	<b>San Joaquin County's Position</b>	<b>Reclamation District 1608's Position</b>
Lead Investigative Agency	<p>The County should be responsible since:</p> <ul style="list-style-type: none"> <li>The County is responsible for maintaining the creeks and sloughs throughout Stockton (Allen 2000).</li> <li>The County controls the water level using the weir at Five Mile Dam (Allen 2000).</li> </ul>	<p>The City should be responsible since:</p> <ul style="list-style-type: none"> <li>The City receives the benefit of the irrigation water from Five Mile Dam (Pulver 1998).</li> <li>The City is responsible for maintaining the roadway culverts and pumps in Five Mile Slough and Five Mile Creek (Allen 2000).</li> <li>The lands along the creek are privately owned (Pulver 1998).</li> <li>The City controls the bulk of the storm drainage that enters Five Mile Slough and Five Creek (Chavez 2018)</li> <li>Most of the development that discharges into Five Mile Slough and Five Mile Creek was approved by the City (Chavez 2018)</li> </ul>	N/A
Water Hyacinth	<p>The County should be responsible since:</p> <ul style="list-style-type: none"> <li>The County is responsible for flood control (Lewis 2002).</li> <li>The City has no jurisdiction for maintaining any waterway in Stockton, and that by</li> </ul>	<p>The County is not responsible since:</p> <ul style="list-style-type: none"> <li>Water hyacinth is not a flood control issue, according to a 1972 United States Army Corps of Engineers Study (Callahan 2002).</li> </ul>	<p>The County should be responsible since:</p> <ul style="list-style-type: none"> <li>The Reclamation District has no responsibility for clearing or cleaning the slough (Stovall 2002).</li> </ul>

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	addressing the issue in Five Mile Slough and Five Mile Creek, it would create a precedent for the City to manage water hyacinth in other waterways throughout Stockton (Lewis 2002).	<ul style="list-style-type: none"> <li>Five Mile Creek and Five Mile Slough are considered non-priority projects in Zone 9, which are ineligible for funding for vegetation control (Callahan 2002).</li> <li>Part of Five Mile Slough is outside of Zone 9, which is ineligible for funding (Callahan 2002).</li> </ul>	<ul style="list-style-type: none"> <li>The water hyacinth may block the pump, weir, or culverts, creating a flood control issue, and the County is responsible for flood control, as well as owning and operating Five Mile Dam (Stovall 2002).</li> <li>The County has worked in Five Mile Slough and Five Mile Creek in the past to control water hyacinth (Stovall 2002).</li> </ul>
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## Hydrology

The current watershed size is approximately 1,548 acres, and consists of 7 watersheds. The watershed areas were determined from the 2007 City of Stockton storm drain block book and a watershed map prepared by Condor Earth Technologies in the City of Stockton Stormwater Quality Control Criteria Plan (Larry Walker Associates 2009a). The watershed boundary descriptions are approximate; for a more accurate delineation, refer to Exhibit 1. The pump capacities are provided by the City (19 Oct. 2017 personal communication from M. Sadiq). The water in Five Mile Slough and Five Mile Creek consists primarily of urban storm water runoff, as well as direct groundwater inputs (Kipf 2018).

### Sub-Watershed Descriptions

The Lighthouse sub-watershed was developed around 1981 and is located west of Interstate Route 5 and north of Five Mile Slough. It is approximately 184.0 acres. Runoff in the watershed drains via storm drain to a lake, which acts as a detention basin for the watershed (Siegfried 1981). The lake drains to the Lighthouse Pump Station, which discharges to Five Mile Slough at the corner of Schooner Drive and Lighthouse Drive. The Lighthouse Pump Station has a capacity of 8,000 gpm.

The Plymouth sub-watershed was developed between 1967 and 1979 (USGS and DWR 1968a; Siegfried 1979) and is bounded by Interstate Route 5 to the west, Hammer Lane to the north, the mid-block of Richland Way and Westland Avenue to the northeast, and Swenson Golf Course to the southeast. It is approximately 193.3 acres, and drains via storm drain to the Plymouth Pump Station, which discharges

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into Five Mile Slough near the Plymouth Road crossing. The Plymouth Pump Station has a capacity of 15,325 gpm.

The Swenson Park sub-watershed consists of Swenson Park Golf Course which opened in 1952 (City of Stockton 2017). It is approximately 220.8 acres, and discharges directly to Five Mile Slough (Siegfried 1979).

The Bonniebrook sub-watershed was developed between 1953 and 1967 (USGS 1952a; USGS and DWR 1968a). It is bounded by the Swenson Park and Plymouth watersheds in the west, the properties along Alexandria Place, Meadow Avenue, and Andrea Avenue to the east, and a portion of the midblock of Paloma Avenue to the north as well as Hammer Lane from approximately Arroyo Way to Westland Avenue. It is approximately 381.8 acres, and drains via storm drain to the Swenson Park (Bonniebrook) Pump Station, built in 1971 (Siegfried 1979), which discharges into Five Mile Slough at the Swenson Park Golf Course. The Swenson Park (Bonniebrook) Pump Station has a capacity of 23,700 gpm.

The Alexandria sub-watershed was developed between 1953 and 1967 (USGS 1952a; USGS and DWR 1968a). It is bounded to the west by Lincoln Road to the north, the Swenson Park watershed to the west, Benjamin Holt Drive to the south, and Pershing Avenue to the east. It is approximately 147.7 acres and drains to the Alexandria Pump Station, which discharges into Five Mile Slough near the crossing at Alexandria Place. The Alexandria Pump Station has a capacity of 16,160 gpm.

The County sub-watershed was developed between 1953 and 1967 (USGS 1952a; USGS and DWR 1968a). It is bounded by the Bonniebrook watershed to the west, the Alexandria watershed to the south, Pacific Avenue to the east, and a freeform boundary to the north. It is approximately 194.3 acres and discharges to Five Mile Creek via gravity pipes or direct runoff (Siegfried 1979).

The Pacific sub-watershed was developed between 1976 and 2002 (USGS and DWR 1976a; USGS 2002 imagery in Google Earth 2017). It is bounded by Pacific Avenue to the west, Glendora Avenue, Quincy Street, and Benjamin Holt Drive to the south, El Dorado Street to the east, and a freeform boundary to the north. It is approximately 226.2 acres and drains to the Pacific Pump Station, which discharges into Five Mile Slough at the headwaters near Pacific Avenue and Rivera Road. The Pacific Pump Station has a capacity of 18,100 gpm.

### Conclusion

Typically, in an undeveloped watershed, stormwater has more opportunities than in a developed watershed to infiltrate or evaporate before it reaches surface waters, resulting in more consistent flow and opportunities for plants to treat pollutants in stormwater. The addition of impervious surfaces such as pavement, roofs, and buildings, as well as new storm drain systems and new stormwater runoff that come with development and new projects, decrease the amount of time it takes for stormwater to reach creeks and rivers, and results in large flows during storm events and less flow before or after storm events, which contribute to flooding problems during storm events and water quality problems during other times because there is less water to dilute pollutants. In addition, stormwater in developed areas tend to be more concentrated with pollutants, which also contribute to water quality problems. Based on the history of the watershed, this is true as well for Five Mile Slough and Five Mile Creek. In addition, we have

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discovered that the watershed pumps that pump water in and out of the waterway, are sized appropriately and are functioning properly to maintain safe water elevations during the winter and irrigation levels during the summer.

## **Hydraulics**

### History of Stream Alterations

Refer to Figure 9 below for a summary of stream alterations to Five Mile Slough and Five Mile Creek. Between 1894 and 1907, earthen fill was constructed at the present-day location of Five Mile Dam, separating Five Mile Slough from Fourteen Mile Slough (USGS 1898; USGS 1910). The headwaters of Five Mile Creek were once located on the north side of Hammer Lane near the present-day Lan Ark Drive and East Iris Avenue. Between 1907 and 1953, Five Mile Creek was cut off at Hammer Lane (USGS 1953). Around 1963, Five Mile Creek upstream of Pacific Avenue was removed as part of the construction of Breuner's Home Furnishings; the creek was converted into a ditch that extended along the south side of Hammer Lane to Western Pacific Railroad (USGS 1953; 1968a; Siegfried 1963). In 1959, a pump was installed at the present-day location of Five Mile Dam for the County to operate and attempt to maintain the water level in Five Mile Slough and Five Mile Creek (Pulver 1998). Around 1976, the pump was relocated and installed as part of Five Mile Dam, which added gates as well as a weir to control the water level more effectively (Siegfried 1976). Five Mile Dam was designed with an option for a future second pump to be installed, but the second pump has not been installed, and the existing pump has not been upgraded since it was installed. The pump has a capacity of 20,000 gpm (Siegfried 1979; 10 Oct. 2017 meeting with San Joaquin County). Around 2002, when Breuner's Home Furnishings closed at Pacific Avenue and Hammer Lane, the ditch was removed and the flow from the ditch was re-routed to Mosher Slough via underground pipe and a pump station (Siegfried 1991; USGS 2002 imagery in Google Earth 2017), which decreased the amount of tributary area and source water.

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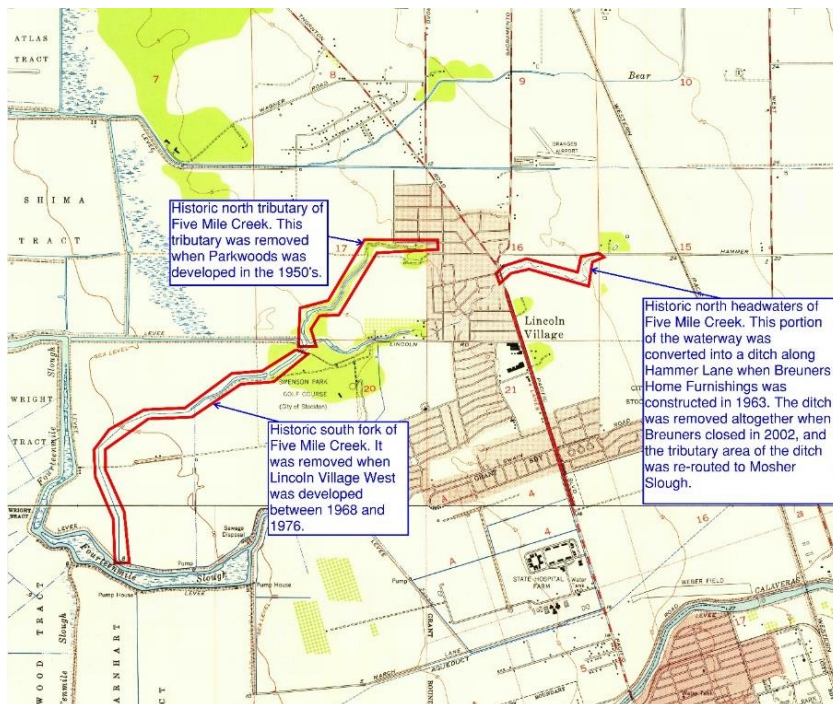
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Figure 9. Summary of stream alterations to Five Mile Creek and Five Mile Slough.



Five Mile Slough had a tributary extending approximately from the present-day location of Bonniebrook Drive between Parkwoods Drive and Woodside Drive to the present-day location of Misty Lane and El Camino Avenue, north of Hammer Lane (USGS 1910; 1953; USGS and DWR 1968). This tributary was removed when the Parkwoods residential development was constructed (USGS 1953; USGS and DWR 1968a).

Five Mile Creek also had a fork that extended south to the present-day location of North Lake that was cut off between 1894 and 1908 (USGS 1910). Evidence of the forks' existence include the locations of the lakes on Swenson Golf Course and a green belt extending through the Lincoln Village West area. According to a USGS topographic map from 1898, in 1894, Five Mile Creek has a similar meander to the present-day Fourteen Mile Slough near the confluence of the San Joaquin River, as well as a similar meander to the south fork. It is not known whether this fork was part of Five Mile Creek in 1894, a fork that was created when Five Mile Slough was straightened, or was not documented on the 1898 map. On the 1953 USGS map, a levee is shown cutting the south fork off from Five Mile Creek. It is not known when this levee was constructed.

#### Present Conditions

Refer to Exhibit 2 for a profile of Five Mile Slough and Five Mile Creek that was surveyed in September 2017. Five Mile Slough is characterized by stagnant water with an approximately level water surface throughout the slough like a series of lakes separated by the culvert crossings, which is consistent with the "swamp or shallow lake system" definition of a slough. The portion of Five Mile Creek from Alexandria

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Place to Caran Avenue also has an approximately level water surface and experiences stagnation. The bed of Five Mile Slough and Five Mile Creek is sloped from Fourteen Mile Slough to Interstate Route 5 and Swenson Park Golf Course, while the bed is relatively flat between Swenson Park Golf Course and Caran Avenue. The culverts constructed at Alexandria Place in 1957 are buried in sediment (City of Stockton 1957). The controlling elevation in Five Mile Slough is the top of the roadway at Alexandria Place, which is at 8.28 ft NAVD 88.

The water level in Five Mile Slough and Five Mile Creek is affected by the weir and pump operation at Five Mile Dam, the pumps and pipe outlets that discharge stormwater into Five Mile Slough and Five Mile Creek, and the roadway culverts. The irrigation pump at Swenson Golf Course and evaporation also influence water levels, but to a lesser extent. According to the United States Natural Resource Conservation Service Web Soil Survey (2017), the soils underlying Five Mile Slough and Five Mile Creek likely have little or no infiltration.

Five Mile Dam maintains the water in Five Mile Slough and Five Mile Creek at a higher elevation in the summertime from April 15 to October 30, when the screw gate is adjusted to 13-15 inches above the weir, and maintains the water at a lower elevation in the winter time from November 1 to April 14, when the screw gate is adjusted to 4-8 inches above the weir (Siegfried 1976; 10 Oct. 2017 meeting with San Joaquin County). At the time the pump at Fourteen Mile Slough was constructed in 1959 before the construction of Five Mile Dam, the operation was intended to maintain the water level in the slough and creek at 2 ft mean sea level (approximately 4.39 ft NAVD88), not to exceed 3 ft mean sea level (approximately 5.39 ft NAVD88) (Pulver 1998).

Based on surveys and site visits performed between September and December 2017, Five Mile Creek is periodically dry between Pacific Avenue and Pershing Avenue. Water backs up in Five Mile Slough and Five Mile Creek between Caran Avenue and Five Mile Dam when the water in Five Mile Creek and Five Mile Slough is regulated at the summer water level, with high waters observed between Pershing Avenue and Plymouth Road. Residents have raised awareness about high water in Five Mile Creek upstream of Alexandria Place as well as flooding in Five Mile Slough along Hazelwood Avenue (30 Oct. 2017 Friends of Five Mile Creek Steering Committee Meeting).

The lack of freshwater inputs from upstream due to the usage of Five Mile Slough and Five Mile Creek as a storm channel for urban runoff, the lack of connection with Fourteen Mile Slough, and low flow effectively allows pollutants to concentrate and sediment to build up in Five Mile Slough and Five Mile Creek.

Preliminary calculations show that the existing culverts have the capacity to handle the flows within Five Mile Slough and Five Mile Creek. In addition, if the outfall pumping rate is doubled by San Joaquin County, preliminary analysis shows that the existing culverts have the capacity to handle this increase in flow.

### Conclusion

Over time, sediment accumulation decreases the volume capacity of Five Mile Slough and Five Mile Creek. However, Five Mile Dam has the capacity for the construction of an additional pump, to increase

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flow output and combat decreases in volume capacity. San Joaquin County does not consider dredging as a viable option, and instead would install a secondary pump if detention capacity is reduced over time. Per Action Item No. 3, in Table 6, Potential Future Actions, San Joaquin County is installing a gage to more closely monitor water levels.

## **Water Quality**

### History

The majority of Five Mile Creek and Five Mile Slough was developed before the introduction of water quality laws, such as the federal Clean Water Act in 1972 and California's Porter-Cologne Act in 1969. Thus, modern strategies to protect water quality such as low impact development (LID) and stormwater best management practices (BMP's) had not yet been implemented. Water quality monitoring efforts in the watershed began in 1992, and the City and the County became co-permittees under the City's National Pollution Discharge Elimination System (NPDES) Municipal Stormwater Permit in 1995. The City has renewed its permit three times since, with the most recent permit adopted by the California Central Valley Regional Water Quality Control Board (CVRWQCB) on June 23, 2016 (Kipf 2018). In general, the NPDES permit outlines discharge prohibitions and requires the City to identify water quality issues, develop milestones and a schedule for resolving the water quality issues, develop, maintain, and implement a Stormwater Management Plan (SWMP) that outlines the City's proposed compliance efforts; assesses whether the proposed compliance efforts and milestones are effective, and requires corrective actions if water quality objectives are still not being met. This process repeats until water quality objectives are satisfied. Failure to effectively implement the SWMP results in violations (CVRWQCB 2016).

In 2002, the CVRWQCB added Five Mile Slough from Alexandria Place to Fourteen Mile Slough, to the Clean Water Act 303(d) list of impaired waterbodies for failing to meet water quality standards for the pesticides Chlorpyrifos and Diazinon, pathogens, and organic enrichment/low dissolved oxygen (SWRCB 2002). This triggered the development of Total Maximum Daily Loads (TMDLs) to assess the maximum pollutant loads that Five Mile Slough can assimilate without violating water quality standards. Total Maximum Daily Loads resulting from urban runoff have individual compliance requirements (CVRWQCB 2016). Between 2002 and 2008 the CVRWQCB established water quality objectives for Chlorpyrifos, Diazinon, and pathogens based on the results of multiple sampling studies performed in the Delta between 1988 and 2005 (CVRWQCB 2006 and 2008). In addition, the San Joaquin River, which is downstream of Five Mile Slough, is 303-d listed as impaired for dissolved oxygen and has numeric water quality objectives (Kipf 2018). The TMDL endpoints that were established for Five Mile Slough and the San Joaquin River are listed in Table 2 below. Monitoring efforts specific to Five Mile Creek and Five Mile Slough primarily consist of the Sediment Toxicity Work Plan and the Pesticide, Pathogen, and Low Dissolved Oxygen (DO) Plans, which included monitoring for sediment toxicity, pathogens, pesticides, and oxygen-demanding substances (Kipf 2018).

As required by the NPDES permit, the City conducts monitoring programs that involve testing for sediment toxicity, pesticides, pathogens, dissolved oxygen, and mercury. In addition, the City also

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monitors the outfalls in Five Mile Slough and Five Mile Creek as part of a dry weather screening program to identify possible illicit discharges and illicit connections (Kipf 2018).

Table 2. Summary of Total Maximum Daily Load (TMDL) numeric objectives.

<u>Pollutant</u>	<u>TMDL End Point</u>	<u>Deadline for Attainment of Pollutant Loads</u> <sup>4</sup>
Diazinon	<ul style="list-style-type: none"> <li>0.16 µg/L as a 1-hour average<sup>1</sup></li> <li>0.10 µg/L as a 4-day average not to be exceeded more than once in a three year period<sup>1</sup></li> </ul>	Dec. 01, 2011
Chlorpyrifos	<ul style="list-style-type: none"> <li>0.025 ug/L as a 1-hour average<sup>1</sup></li> <li>0.015 ug/L as a 4-day average not to be exceeded more than once in a three year period<sup>1</sup></li> </ul>	Dec. 01, 2011
Pathogens	<ul style="list-style-type: none"> <li>Fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a geometric mean of 200/100 ml; nor shall more than ten percent of the total number of samples taken during any 30 day period exceed 400/100 ml<sup>2</sup></li> <li>Geometric mean <i>E. coli</i> concentration of 126/100 ml, based on a statistically sufficient number of samples (generally not less than 5 samples equally spaced over a 30-day period); and no sample should exceed a single sample maximum allowable concentration of 235 MPN/100 ml<sup>2</sup></li> </ul>	June 30, 2018
Nutrients/Low Dissolved Oxygen	<ul style="list-style-type: none"> <li>TMDL needed for Five Mile Slough<sup>1</sup></li> <li>6.0 mg/L between September 1 and November 30 and above 5.0 mg/L all other times (in the San Joaquin River, downstream of Five Mile Slough)<sup>3</sup></li> </ul>	Dec. 31, 2011

<sup>1</sup> EPA 2012

<sup>2</sup> CVRWQCB 2008

<sup>3</sup> Kipf 2018

<sup>4</sup> CVRWQCB 2016

As of 2012, TMDLs for Chlorpyrifos, Diazinon, and pathogens have been established, but Five Mile Slough remains impaired by Chlorpyrifos, Diazinon, pathogens, and organic enrichment/low dissolved oxygen (EPA 2012). The beneficial uses of Five Mile Slough that have been impaired include Warm Freshwater Habitat due to Diazinon and Chlorpyrifos pesticides and Organic Enrichment/Oxygen Depletion (Low DO), as well as Water Contact Recreation due to pathogens (Kipf 2018).

For more information about water quality, refer to the *Five Mile Slough Water Quality Evaluation Alexandria Place and Lincoln Road, Stockton, California* prepared by Condor Earth (Kipf 2018).

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### Sediment Toxicity

According to the 2013 Sediment Toxicity Final Report, sediment toxicity monitoring and testing was conducted on the sediments in Five Mile Slough at Swenson Golf Course, a point just downstream of the Swenson (Bonniebrook) Pump Station (Larry Walker Associates 2009b; Kipf 2018). Based on a bioassay study using the amphipod *Hyalella azteca* (*Hyalella*), statistically significant sediment toxicity was not observed (Kipf 2018).

### Pesticides

Chlorpyrifos and Diazinon are organophosphate pesticides that have been used for insect control since the 1950's and 1960's. Both pesticides have been under increased scrutiny by the U.S. Environmental Protection Agency (EPA) due to health risks to wildlife and people (Harper et al. 2009; EPA 2017). Chlorpyrifos generally adsorbs to sediment, where it can persist in the environment with an average half-life of 30 days, while diazinon is soluble in water with a half-life of between 5 to 25 days (CVRWQCB 2006). According to the 2006 final staff report for the Chlorpyrifos and Diazinon TMDL by the CVRWQCB, the most probable sources of Chlorpyrifos and Diazinon are from atmospheric deposition resulting from agricultural use as well as stormwater runoff and sediment from urban areas.

According to the 2009 Pesticide Plan, water quality samples that were collected at Five Mile Dam tested positive for Chlorpyrifos during two non-dormant spray season storms as well as positive for Diazinon during one dormant spray season wet weather event, two non-dormant spray season wet weather events, and one dry weather event (Larry Walker Associates 2009b; Kipf 2018). Two pyrethroid pesticides, Cypermethrin and Cyfluthrin, were also detected during one non-dormant and one dry weather event respectively. Pesticide impairment is most likely attributed to agricultural application and rainwater for Chlorpyrifos as well as urban runoff for pyrethroid pesticides. Residential application of Chlorpyrifos and Diazinon may also contribute to responsibility for impairment (Kipf 2018).

### Pathogens

Deltakeeper (part of San Francisco Baykeeper) collected pathogen samples in urban creeks in Stockton, including Five Mile Slough at Alexandria Place and Plymouth Road, between 2000 and 2001 (cited in CVRWQCB 2008), and between 2000 and 2005 (unpublished data, cited in CVRWQCB 2008). The *E. Coli* concentrations in the water samples were elevated, particularly at the beginning of the 2000 rainy season, which according to Deltakeeper, were thought to be related to stormwater runoff.

According to the Pathogen Plan monitoring results in 2007, 24 dry weather and five wet weather water quality samples were taken throughout Five Mile Slough at both receiving water locations and discharge locations (Kipf 2018). Pathogens were most concentrated in upstream urban discharge samples, taken at the Alexandria Pump Station and the Plymouth Pump Station (Larry Walker Associates 2009b; Kipf 2018); and lowest in the samples taken at Five Mile Dam. Between 26% and 47% of the samples exceeded numeric objectives for both *E. coli* and fecal coliform indicators, both acute and chronic monitoring levels, and both wet weather and dry weather samples. In addition, a Phase II source effort between 2009 and 2010 found human and dog indicator organisms in both wet weather and dry weather events at the Alexandria Place Pump Station, Plymouth Road Pump Station, and at the receiving water

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monitoring location for Plymouth Road Pump Station. Human inputs were primarily found during dry weather events (Kipf 2018).

#### Nutrients and Low Dissolved Oxygen

As part of the 2009 Low Dissolved Oxygen Plan, dry and wet season sediment samples were collected at the receiving water monitoring locations for the Lighthouse and the Alexandria Place Pump Stations to evaluate total organic carbon, sediment oxygen demand (SOD), biochemical oxygen demand (BOD), and chemical oxygen demand (COD). The results showed that in some areas, there is a high potential for sediments to exert an oxygen demand if resuspended. Due to the shallow depths in Five Mile Slough, the potential for scour and resuspension from large discharges is elevated (Kipf 2018).

In general, the Stockton watershed experiences problems with eutrophication, warmer summer water temperatures, and sediment oxygen demands which all contribute to oxygen depletion (Kipf 2018). The presence of dense aquatic weed growth in the waterway is an indicator of nutrient enrichment. When the plants die, microbes consume the detritus, particularly on the bottom of the waterway, and in the process, consume dissolved oxygen, thus creating an oxygen demand. Problems with nutrient enrichment are attributed to the improper application of fertilizers in the watershed (Kipf 2018).

#### Trash

On-site visits in September and December 2017, trash was noted in Five Mile Creek, including evidence of illegal dumping. In addition to aesthetic impacts, and potentially physically harming wildlife and people, trash can contribute to problems with nutrient enrichment.

#### Aquatic Weeds

The invasive aquatic weeds that have been reported in Five Mile Slough include water hyacinth, duckweed, water primrose, Azolla, Eurasian milfoil, and algae (Stovall 2002; Lewis 2002; Callahan 2002; Kleinschmidt and Huffman 2003; 30 Oct. 2017 Friends of Five Mile Creek Steering Committee Meeting). As mentioned previously, the aquatic weeds are an indicator of nutrient enrichment and can contribute to problems with low dissolved oxygen.

#### Existing Best Management Practices

Existing Best Management Practices (BMP's) employed by both the City and the County include Integrated Pest Management program, holding public education and outreach efforts, inspecting commercial and industrial developments for pollutant discharges, performing street sweeping, and using a pesticide and fertilizer application protocol to control pesticides, fertilizers, and organic waste. In addition, the City added a dry weather diversion at the Swenson Park (Bonniebrook) Pump Station in 2011 that routes dry weather storm flows to the sewer system for treatment at the City Regional Wastewater Control Facility (Kipf 2018).

#### Conclusion

Despite reported impairments, the City of Stockton meets the SWMP implementation requirements, by the various programs that are in place, the monitoring that is being conducted, and the State reporting

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that is being performed. The City of Stockton will continue with its programs and will continue to monitor, as part of the SWMP; however, no action items are required by the State of California.

## **Ecology**

Simpson (2018) with BaseCamp Environmental Inc., prepared a draft environmental report that assessed the ecology of Five Mile Creek and Five Mile Slough. Water quality is impaired and waters, where present, can be assumed to be warm, and oxygen-deficient with relatively high organic, nutrient, pathogen, dissolved metal, and other contaminants. Ponded waters are subject to regular if not constant algal blooms, which are unsightly and exacerbate water quality problems. Sediment accumulation in portions of the slough has substantially reduced depth.

Biological values along the waterway are relatively low. Aquatic resources are limited due to the lack of flows, lack of connection to the Delta and poor water quality. There is little to no well-developed riparian vegetation. The slough west of Swenson Park is intensively maintained by the flood control agency; the channel is dredged, and the banks are denuded and covered with rip-rap. Some sparse riparian vegetation has developed along the south bank where the slough abuts Swenson Park and portions of Lincoln Road. The banks of the creek east of Caran Avenue are relatively undisturbed but heavily shaded by ornamental trees and shrubs; this combined with landowner and City maintenance activities has prevented the substantial development of riparian species. Other than raptor nesting, it is highly unlikely that any portion of the waterway is populated or used by special-status species. The waterway corridor probably provides some amphibian habitat and limited wildlife movement values for a restricted list of smaller mammal species that are accustomed to urban environments.

### Possible Improvement Objectives

Some constraints exist that limit environmental remediation opportunities. West of Alexandria, the slough is located within a relatively narrow, publicly-owned and access-restricted right-of-way; most of the right-of-way is fully occupied by the channel, rip-rapped banks and maintenance access roads providing little to no room for enhancement. Along most of the creek section, adjacent private residential land ownership limits access to the immediate vicinity of public road crossings. As the watershed area is restricted in size and its outflow regulated by the Five Mile Dam, it does not appear that any substantial effort to improve flow capacity would be beneficial.

For the purposes of this analysis, possible improvements were limited to activities that might result in hydraulic or environmental benefits, including the following:

Five Mile Dam: Modification of the dam to permit additional drawdown of water levels might facilitate other maintenance or enhancement activities, but the feasibility and value of such improvements are unquantified and unknown. Due to the limited range of existing weir board elevations, and existing poor habitat conditions, modification of weir board management would not seem to be of any substantial environmental value. However, in the event that a wider wetted area could be established along the Swenson Park frontage, the ability to affect small changes in water elevation might be useful.

Sediment Removal: Removal of existing accumulated sediment in accessible portions of the slough, for example along Hazelwood Avenue, would offer an opportunity to increase water storage volume and

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depth leading to incremental, although likely minor, water quality and aquatic habitat value improvements. Sediment removal would also help with controlling aquatic weeds by increasing the channel depth.

Slough Widening or Wetlands: Opportunities exist along the Swenson Park frontage to widen and/or deepen the slough, or to create wetland and riparian areas, on this adjacent publicly-owned property. The feasibility of wetland enhancement might be increased if linked to the conversion of the golf course to other land uses, which is being explored by the City. Widening improvements could result in some notable improvement in habitat values, but not likely changes in the fish and/or wildlife species diversity or populations accommodated by the slough.

Non-Native and Invasive Species Removal: The edge of Five Mile Slough and Five Mile Creek has become populated by pampas grass and other invasive species. Eradication of these plants would prevent further propagation and re-establish space for planting or regeneration of native species, to the benefit of native mammal and bird species. Replacement of non-native ornamental trees with native species east of Caran Avenue would incrementally improve the habitat value of this portion of the slough. Ownership and access control for these lands are, however, private, including commercial areas adjacent to Pacific Avenue. Any vegetation replacement program would need to involve the adjacent owners, but with landowner interest and cooperation, available stream restoration funding might be used to improve both the habitat value and the appearance of these areas.

Ponded portions of the waterway have had recurring problems with aquatic invasive species such as water hyacinth, duckweed and other similar species. These problems might be improved by improved water circulation and flow; however, the costs of control, funding sources and available technology need to be explored.

Ponded Water Circulation: Provision of a system for artificial circulation and aeration of ponded water might offer opportunities for aesthetic and water quality improvement as well as invasive species control along the ponded portions of the waterway. Such a plan would involve some substantial initial costs as well as operation and maintenance expenses, although the cost would be mitigated if the City can provide the real estate. It is conceivable that some adjacent owners might be willing to participate in costs if a clear benefit could be demonstrated. This may reduce the proliferation of invasive species but it is not expected to solve the problem alone without other aquatic weed control methods, such as physical removal. A focused study would be needed to establish feasibility.

### Conclusion

The governing agencies are in compliance with currently applicable requirements. No actions are required to be taken at this time; however, the City of Stockton will continue its monitoring efforts. The pursuit of available waterway grants, such as the Proposition 1 Ecosystem Restoration and Water Quality Grant Program (<http://deltaconservancy.ca.gov/prop-1/>), by a potential Assessment District, is highly suggested. Refer to Action Item No. 6, in Table 6, Potential Future Actions, for further information.

## **Stakeholder and Agency Responsibilities**

Refer to Table 3 below for a matrix of stakeholder and agency responsibilities and jurisdictions. Five Mile Slough and Five Mile Creek fall under a patchwork of City, County, and private ownership. Five Mile Dam

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is operated by San Joaquin County (Allen 2000; Stovall 2002; Lewis 2002), the City owns Five Mile Slough adjacent to Swenson Golf Course (Allen 2000), and the remainder of Five Mile Slough and Five Mile Creek is privately owned (Pulver 1998), with property owners mostly under City jurisdiction, with some residents under County jurisdiction (Allen 2000; Lewis 2002; City of Stockton GIS Data; San Joaquin County GIS Data). San Joaquin County maintains flood control facilities in Stockton that are in Zone 9, which includes some limited maintenance of waterways (Chavez 2018). The City of Stockton maintains the culverts underneath the roads crossing Five Mile Slough and Five Mile Creek (Pulver 1998). The levees are owned and maintained by Reclamation District 1608 along the south side and Reclamation District 2115 on the north side (Kleinschmidt and Huffman 2003; Stovall 2002; Lewis 2002).

Provided below is the contact number for each agency.

- City of Stockton | 209-937-8411
- San Joaquin County | 209-468-3000
- SJAFCA (San Joaquin Area Flood Control Agency) | 209-937-7900
- Reclamation District 1608 | 209-948-8200
- Reclamation District 2115 | 209-948-8200

### Conclusion

With a continued lack of a single point of contact or managing agency, it is recommended that an Assessment District, or Association, or Community Facilities District, or Property and Business Improvement District, is formed to provide a mechanism to fund a sole point of contact that will manage the various stakeholders. Refer to Action Item No. 6, in Table 6, Potential Future Actions, for additional information.

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Table 3. Responsibility matrix for Five Mile Slough and Five Mile Creek.

	Culverts <sup>1</sup>	Public Bridges	Private Bridges	Five Mile Dam	Pump Stations <sup>2</sup>	Water Quality Monitoring and Regulation	Water Level Control	Flood Control <sup>3</sup>	Aesthetics	Invasive Plant Abatement	Bank Erosion	Culvert Hydraulics	Maintenance (Debris Cleanup, Bank Vegetation)	Levees <sup>5</sup>
<b>City of Stockton</b>	X	X			X	X				X	X	X	X	
<b>San Joaquin County</b>	X			X	X	X	X	X <sup>4</sup>			X	X	X <sup>4</sup>	X
<b>SJAFCA (San Joaquin Area Flood Control Agency)</b>								X			X <sup>6</sup>			
<b>Reclamation District 1608</b>								X			X		X	X
<b>Reclamation District 2115</b>								X			X		X	X
<b>Property Owners</b>			X						X	X	X		X	

<sup>1</sup> Culverts within the project area are: Interstate Route 5, Plymouth Road, Alexandria Place, Pershing Avenue, Caran Avenue, and Pacific Avenue/Rivara Road. Refer to Exhibit 2, Schematic Profile of Five Mile Slough and Five Mile Creek.

<sup>2</sup> Pump Stations within the project area are: Five Mile Dam, Lighthouse, Plymouth, Swenson Park (Bonniebrook), Alexandria, and Pacific. Refer to Exhibit 1, Watershed Map of Five Mile Slough and Five Mile Creek.

<sup>3</sup> Flood Control is the act or technique of controlling river flow with dams, dikes, artificial channels, etc., in an effort to minimize the occurrence of floods.

<sup>4</sup> Responsibility limited to San Joaquin County's project channel, generally defined as ending near the westerly end of Swenson Park Golf Course -- coinciding with the boundary for Reclamation District 1608, shown on Exhibit 1, Watershed Map of Five Mile Slough and Five Mile Creek.

<sup>5</sup> Levees are only located within the Reclamation District boundaries. Refer to Exhibit 1, Watershed Map of Five Mile Slough and Five Mile Creek.

<sup>6</sup> Responsibility limited to the intake and outfall at Five Mile Dam.

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## **Environmental Compliance Requirements**

Improvements to Five Mile Slough and Five Mile Creek, beyond routine vegetation removal and replanting, would require a range of federal and state permit approvals related to work in streams and wetlands (Simpson 2018). These permit requirements are summarized below. Permitting timelines vary, depending on the project and the circumstances.

**U.S. Army Corps of Engineers:** A permit is required under Section 404 of the Clean Water Act for construction activities within Waters of the U.S., including wetlands.

**California Regional Water Quality Control Board:** State certification that a project requiring a Section 404 permit complies with Section 401 of the Clean Water Act must be obtained.

**California Department of Fish and Wildlife:** A permit is required for projects that alter the bed, banks or channel of a lake or stream under Section 1600 of the California Fish and Game Code.

**Central Valley Flood Protection Board:** Improvements to Five Mile Slough west of Swenson Park would require an encroachment permit from the Central Valley Flood Protection Board. The remainder of the waterway is not within the jurisdiction of the CVFPB.

### **Conclusion**

Some of the improvements, notably slough widening and water circulation system, would likely require review under the California Environmental Quality Act (CEQA). Vegetation replacement, minor modifications to the Five Mile Dam and, under certain circumstances, minor sediment removal would likely be considered exempt from CEQA review. But no task within Five Mile Slough and Five Mile Creek will be free of complexities; there are many facets. An overview of the various environmental permitting agencies, including approximate cost ranges and timelines, is provided in Table 4 below.

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Table 4. Environmental permitting matrix for waterway improvements.

	Slough/Creek Widening	Wetlands or Other Naturalized Treatment Systems	Water Circulation System	Vegetation Removal	Dredging/Sediment Removal	Modifications to Five Mile Dam	Culvert Removal and Replacement	Bridge Modification
City of Stockton	X	X			X		X	
San Joaquin County	X	X	X	X	X	X	X	X
U.S. Army Corps of Engineers	X	X	X	X	X	X	X	X
California Regional Water Quality Control Board	X	X	X	X	X	X	X	X
California Department of Fish and Wildlife	X	X	X	X	X	X	X	X
Central Valley Flood Protection Board (West of Swenson Park)	X	X	X	X	X	X	X	X
Approximate Cost Range	\$20-40K	\$10-20K	\$10K	\$10-50K	\$50-90K	\$20-100K	\$10K	\$10K
Approximate Timeline	36-48 MONTHS	18 MONTHS	18 MONTHS	12-36 MONTHS	36-60 MONTHS	36-60 MONTHS	16 MONTHS	18 MONTHS

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## Friends of Five Mile Creek

Table 5 below provides responses to the Friends of Five Mile Creek (FFMC) document, entitled “Concerns Related to the Alexandria and Five Mile Slough Project Study Report.” This FFMC document is included as Exhibit 4.

Table 5. Responses to FFMC Steering Committee Concerns

No.	Section	FFMC Concern	Response
1	4.3.1	The Project Study Report’s “History of Five Mile Creek” may not reference or use anecdotal evidence from long-time Stockton residents with first-hand knowledge of the history of Five Mile Creek.	Anecdotal evidence from long-time Stockton residents, such as those in FFMC, are used and referenced in this Report. Refer to Pages 6 through 15, History.
2	4.3.2	Because the City of Stockton and San Joaquin County are co-permittees for the “National Pollutant Discharge Elimination Permit” (NPDES) it is difficult to know which agency is responsible for each section of Stockton’s “Storm Water Management Plan.”	The City of Stockton is responsible for each section of the Stormwater Management Plan (SWMP) for areas within the City’s limits, and San Joaquin County is responsible for each section of the SWMP for areas within the County’s limits. For the City limits and the County (or unincorporated area) limits in the area of the project, refer to Exhibit 1, Five Mile Slough and Five Mile Creek Watershed. The City limits are shown in yellow color, and the County limits are shown in white color. For a larger map of the City limits and the County limits, refer to the map that is available at this link: <a href="http://www.stocktongov.com/files/CityMap.pdf">http://www.stocktongov.com/files/CityMap.pdf</a>
3	4.3.2	Because Five Mile Creek runs through both the City of Stockton and San Joaquin County it is difficult for homeowners to distinguish each agency’s common responsibilities in different jurisdictions.	Refer to Table 3, Responsibility matrix for Five Mile Slough and Five Mile Creek, for agency responsibilities and jurisdictions.
4	4.3.2	Which agency in each jurisdiction is responsible for obstructions to flow?  1. removing fallen trees?	  1. Property owners.

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		<ol style="list-style-type: none"> <li>2. removing beaver dams?</li> <li>3. removing trash and debris?</li> <li>4. removing aquatic weeds?</li> <li>5. removing sediment?</li> </ol>	<ol style="list-style-type: none"> <li>2. San Joaquin County.</li> <li>3. Property owners.</li> <li>4. Property owners.</li> <li>5. Property owners.</li> </ol>
5	4.3.2	<p>Which agency in each jurisdiction is responsible for the inspection, maintenance, and code compliance of man-made structures?</p> <ol style="list-style-type: none"> <li>1. Alexandria Place pipe culvert?</li> <li>2. Pershing Avenue bridge?</li> <li>3. Caran Avenue box culvert?</li> <li>4. Pacific Avenue box culvert?</li> <li>5. Pacific Avenue pump station?</li> <li>6. Alexandria Place pump station?</li> </ol>	<ol style="list-style-type: none"> <li>1. City of Stockton.</li> <li>2. City of Stockton.</li> <li>3. San Joaquin County.</li> <li>4. City of Stockton.</li> <li>5. City of Stockton.</li> <li>6. City of Stockton.</li> </ol>
6	4.3.2	<p>Which agency in each jurisdiction is responsible for</p> <ol style="list-style-type: none"> <li>1. testing water quality?</li> <li>2. complying with state and federal water quality standards?</li> <li>3. complying with state and federal water quality requirements?</li> <li>4. removing siltation caused by pump station discharges?</li> <li>5. removing aquatic weeds between the Swenson Golf Course and Hazelwood Ave.?</li> <li>6. removing aquatic weeds between Oak Creek Drive and Alexandria Place?</li> <li>7. removing aquatic weeds between Alexandria Place and Pacific Avenue?</li> <li>8. removing aquatic weeds from the intake cove/bay at Swenson Golf Course?</li> <li>9. addressing water quality issues between Pacific Avenue and Alexandria Place?</li> </ol>	<ol style="list-style-type: none"> <li>1. City of Stockton.</li> <li>2. City of Stockton and San Joaquin County.</li> <li>3. City of Stockton and San Joaquin County.</li> <li>4. No one.</li> <li>5. Property owners.</li> <li>6. Property owners.</li> <li>7. Property owners.</li> <li>8. Property owners.</li> <li>9. No one.</li> </ol>
7	4.3.2	<p>Which agency in each jurisdiction is responsible for "Post-Construction Storm Water Management" after the completion of the Hammer Lane Widening Project:</p>	<p>The City of Stockton is responsible for maintenance and upkeep on the new filtration device installed in Pershing</p>

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		(see May 26, 2017 letter from the Central Valley Regional Water Quality Control Board to the City of Stockton)  1. "providing treatment BMPs to reduce pollutants in runoff, 2. ensuring existing waters are not used as pollutant source controls and/or treatment controls, 3. preserving and where possible, creating or restoring areas that provide important water quality benefits, such as riparian corridors, wetlands, and buffer zones, 4. limiting disturbances of natural water bodies and natural drainage systems caused by development?"	Avenue, that treats stormwater from the Hammer Lane Widening project.
8	4.3.3	Concerns about obstructions to flow  1. Fallen trees 2. Beaver dams 3. Trash and debris 4. Aquatic weeds 5. Sediment 6. Gas lines 7. Corroded and deteriorated culverts 8. Pipe culverts that impede the movement of aquatic weeds	Refer to the Responses in No. 6, above
9	4.3.3	Concerns about general bank erosion along the creek  1. Flow rates of storm water discharge may cause or contribute to downstream bank erosion.	Refer to Pages 18 and 19, Hydraulics, Present Conditions. City of Stockton and San Joaquin County are the agencies that are responsible for bank erosion, as noted in Table 3, Responsibility matrix for Five Mile Slough and Five Mile Creek.
10	4.3.3	Concerns about existing water quality issues  1. Five Mile Creek is on the Environmental Protection Agency's 303(d) list of "impaired" waterways because the presence of pathogens, organophosphate pesticides (Chlorpyrifos and Diazinon), organic enrichment/low	1. The City of Stockton provides mandated water quality testing, but is not required to mitigate the current condition. 2. Sanitary sewer overflows are monitored and reported by the City of

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		<p>dissolved oxygen, and nutrients.</p> <ol style="list-style-type: none"> <li>Sanitary Sewer Overflows</li> <li>Trash and debris</li> <li>Aquatic weeds</li> <li>Implementation of Stockton's Storm Water Management Plan</li> </ol>	<p>Stockton, in accordance with laws and regulations.</p> <ol style="list-style-type: none"> <li>Trash has become part of the new retroactive State Trash Provisions (program).</li> <li>There is no requirement to remove aquatic weeds.</li> <li>This program is not retroactive. All new projects, such as the Hammer Lane Widening project, are required to comply.</li> </ol>
11	4.3.4	<p>The Alexandria culvert has a history blocking floating aquatic weeds (duckweed and azolla) from moving through the pipe culvert.</p> <ol style="list-style-type: none"> <li>When the storm-water pumps discharge water at full capacity and the flow of the water in the creek is at its strongest, floating weeds are pushed downstream; however, most of the weeds are blocked at the Alexandria Place culvert. <ol style="list-style-type: none"> <li>As the water level increases past the diameter point of the culvert pipe, the horizontal surface area in the pipe decreases, preventing much of the floating weed mass from moving through the culvert.</li> <li>When the pumps stop discharging, the water level drops, and the horizontal space in the pipe once again increases, but the force of the flow is now not strong enough to push the floating weeds through the pipe.</li> <li>The trapped weeds create thick thermal mats, absorbing and trapping heat, increasing the water</li> </ol> </li> </ol>	<p>The City of Stockton will consider these concerns as part of Action Item No. 4, in Table 6, Potential Future Actions.</p>

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		<p>temperature, and decreasing dissolved oxygen levels.</p> <p>d. Low dissolved oxygen has adverse impact on water quality in Five Mile Creek.</p> <p>e. Low dissolved oxygen is also one of the “pollutants/stressor(s)” that caused Five Mile Creek to be included on 303(d) list of impaired waterbodies.</p>	
12	4.3.4	Roadway erosion due to deteriorated headwall.	At Alexandria Place, the City of Stockton will consider this as part of Action Item No. 4, in Table 6, Potential Future Actions.
13	4.3.4	<p>Making a determination on an adequate pipe size should factor in more than just moving water downstream to prevent flooding. Consideration should also be given to other storm water issues that the City of Stockton has identified.</p> <p>1. Low Dissolved Oxygen: Stockton ‘Storm Water Management Plan’ identifies five possible causes of low dissolved oxygen, including “natural vegetation.” (page 9-13 in the Storm Water Management Plan)</p> <p>a. Floating aquatic weeds such as duckweed and azolla are forms of natural vegetation that contribute to the degraded water quality in Five-Mile Creek.</p> <p>b. Consequently, moving floating natural vegetation downstream should also be considered when determining adequate pipe size.</p> <p>2. Enhanced Aesthetic Value: The City of Stockton has identified “Enhanced Aesthetic Value” as a</p>	<p>1. At Alexandria Place, the City of Stockton will consider this concern as part of Action Item No. 4, in Table 6, Potential Future Actions.</p> <p>2. These sections of the SWMP are only applicable to new and redeveloped projects. The Hammer Lane Widening project and the Oakridge Shopping Center are good examples of new projects that are required to comply, and that are complying with the SWMP.</p> <p>Aesthetics are subjective; however, all potential blockages will be considered when sizing the culvert repair or replacement.</p>

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		<p>“benefit” of “implementing the provisions of the City of Stockton and County of San Joaquin MS4 National Pollutant Discharge Elimination System (NPDES) permit.”</p> <p>a. “Enhanced Aesthetic Value: Storm water affects the appearance and quality of a water body, and the desirability of working, living, traveling, or owning property near that water body. Reducing storm water pollution will increase benefits as these water bodies recover and become more desirable.” (see “Fact Sheet City of Stockton and County of San Joaquin Storm Water Discharges from Municipal Separate Storm Sewer System” page 1-3</p> <p>b. Consequently, moving unsightly floating aquatic weeds downstream should also be considered when determining adequate pipe size.</p>	
14	4.3.4	As the water level in the creek rises, the rectilinear structure of a box culvert will provide consistent surface space for floating weeds to move through the culvert.	The City of Stockton will consider this as part of Action Item No. 4, in Table 6, Potential Future Actions.
15	4.3.4	Consequently, issues related to flood control, low dissolved oxygen, and enhanced aesthetic value will all be addressed in a significant and meaningful way.	Understood.
16	4.3.5	Loss of private property due to bank erosion.	Refer to Pages 18 and 19, Hydraulics, Present Conditions. City of Stockton and San Joaquin County are the agencies that are responsible for bank erosion, as noted in

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			Table 3, Responsibility matrix for Five Mile Slough and Five Mile Creek.
17	4.3.5	Deep depressions in the creek bed.	Refer to Pages 18 and 19, Hydraulics, Present Conditions, and Page 24, Ecology.
18	4.3.5	Downstream bank erosion.	Refer to Pages 18 and 19, Hydraulics, Present Conditions. City of Stockton and San Joaquin County are the agencies that are responsible for bank erosion, as noted in Table 3, Responsibility matrix for Five Mile Slough and Five Mile Creek.
19	4.3.6	The high level of sediment could cause flooding.	San Joaquin County will evaluate this, as part of Action Item No. 3, in Table 6, Potential Future Actions. San Joaquin County and SJAFCA are the agencies that are responsible for flood control, as noted in Table 3, Responsibility matrix for Five Mile Slough and Five Mile Creek.
20	4.3.6	The high level of sediment degrades water quality 1. Warmer water temperature 2. Rapid growth of aquatic weeds	Refer to Page 24, Ecology.
21	4.3.6	The high level of sediment may clog any new culvert.	The City of Stockton will consider this as part of Action Item No. 4, in Table 6, Potential Future Actions.

## Potential Future Actions

Outlined in Table 6 below are defined potential future actions.

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Table 6. Potential Future Actions

No.	Action	Benefit	Cost Range	Implementation Timeline
1	Hammer Lane Widening project routing of clean and treated stormwater runoff into Five Mile Slough and Five Mile Creek, by City of Stockton	<ul style="list-style-type: none"> <li>• Increased flow of treated stormwater into Five Mile Slough and Five Mile Creek</li> <li>• Removal of future contributions of sediment and debris from Pershing Avenue</li> <li>• Reduced future erosion in Pershing Avenue</li> </ul>	\$75-100K  (in construction)	2018
2	Implementation of new State-mandated Trash Provisions, by City of Stockton	<ul style="list-style-type: none"> <li>• Reduced trash in waterways</li> <li>• Increased water quality</li> <li>• Increased aesthetics</li> </ul>	N/A	10 YEARS
3	Installation of gage to monitor flow and water level between I-5 and Five Mile Dam, by San Joaquin County	<ul style="list-style-type: none"> <li>• Enhanced flood control monitoring</li> <li>• Enhanced modeling of sedimentation impacts</li> <li>• Proactive approach to required flood control improvements</li> </ul>	>\$20K	12 MONTHS
4	Alexandria Place culvert repair or replacement, and bank repair, by City of Stockton	<ul style="list-style-type: none"> <li>• Improved flow underneath Alexandria Place</li> <li>• Reduced sediment accumulation at Alexandria Place</li> <li>• Reduced bank erosion at Alexandria Place</li> <li>• Increased safety</li> <li>• Increased aesthetics</li> <li>• Improved maintenance</li> </ul>	\$300-750K	18-24 MONTHS

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5	Evaluation of Alexandria Pump Station discharge configuration, by City of Stockton	<ul style="list-style-type: none"> <li>• Reduced sediment transport, if link determined</li> </ul>	\$1-20K	18-30 MONTHS
6	Formation of an Assessment District, or Association, or Community Facilities District, or Property and Business Improvement District, by property owners	<ul style="list-style-type: none"> <li>• Defined funding source for invasive plant removal</li> <li>• Organized structure that includes local agencies</li> <li>• Vehicle to pursue grants, such as the Proposition 1 Ecosystem Restoration and Water Quality Grant Program (<a href="http://deltaconservancy.ca.gov/prop-1/">http://deltaconservancy.ca.gov/prop-1/</a>)</li> <li>• Ability to fund major and long-term projects</li> <li>• Ability to retain a waterway manager</li> </ul>	\$25-50K	8-12 MONTHS

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## References

- Allen, M.L. (2000). "Five-Mile Slough Environmental Restoration." Memorandum to R. Nickerson, City of Stockton Councilmember, City of Stockton Municipal Utilities Department, CA.
- California Department of Fish and Wildlife. (2016). *Streambed Alteration Agreement Notification No. 1600-2016-0172-R2 Five Mile Slough*, Rancho Cordova, CA.
- California Department of Water Resources (DWR). (2017). "San Joaquin R at Rindge Pump." *California Data Exchange Center*, <<https://cdec.water.ca.gov/cgi-progs/queryCSV>>, (6 Oct. 2017).
- California Environmental Protection Agency Regional Water Quality Control Board Central Valley Region. (2006). *Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Diazinon and Chlorpyrifos Runoff into the Sacramento-San Joaquin Delta June 2006 Final Staff Report*, Rancho Cordova, CA.
- California Environmental Protection Agency Regional Quality Control Board Central Valley Region (CVRWQCB). (2016). National Pollutant Discharge Elimination System Permit and Waste Discharge Requirements General Permit for Discharges from Municipal Separate Storm Sewer Systems, Order No. R5-2016-0040, NPDES No. CAS085324, Rancho Cordova, CA.
- California Environmental Protection Agency Regional Water Quality Control Board Central Valley Region (CVRWQCB). (2008). *Total Maximum Daily Load Report for Pathogens in Five-Mile Slough, Lower Calaveras River, Mormon Slough, Mosher Slough, Smith Canal, and Walker Slough San Joaquin Count, CA Final Staff Report*, Rancho Cordova, CA.
- California State Water Resources Control Board (SWRCB). (2002). "2002 Clean Water Act Section 303(d) List of Water Quality Limited Segments." *California Environmental Protection Agency State Water Resources Control Board*, <[https://www.waterboards.ca.gov/water\\_issues/programs/tmdl/303d\\_lists.shtml](https://www.waterboards.ca.gov/water_issues/programs/tmdl/303d_lists.shtml)>, (10 Oct. 2017).
- Callahan, M. (2002). "Water Hyacinth in Five Mile Slough." Letter to J.B. Giottonini, City of Stockton Public Works Director, San Joaquin County Flood Control and Water Conservation District, Stockton, CA.
- Chavez, J. (2018). Email to M. Sadiq, Assistant Engineer, City of Stockton Public Works Department, CA.
- Giottonini, J.B. (2003). "Approve and Adopt SJAFCA Resolutions 03- and 03- Adopting the California Environmental Quality Act (CEQA) Mitigated Negative Declaration and Approving the Aquatic Weed Control Program and Findings." Letter to San Joaquin Area Flood Control Agency, City of Stockton Public Works Department, CA.
- Giottonini, J.B. (1999). "Five-Mile Slough Environmental Restoration." Memorandum to G.A. Podesto, City of Stockton Mayor, City of Stockton Public Works Department, CA.
- Harper, B., Luukinen, B.; Gervais, J.A., Buhl, K., and Stone, D. (2009). *Diazinon General Fact Sheet*, National Pesticide Information Center, Oregon State University Extension Services, <<http://npic.orst.edu/factsheets/Diazgen.html>>, (21 Nov. 2017).

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- Kleinschmidt Associates & The Huffman-Broadway Group, Inc. (2003). *Five Mile Slough Aquatic Weed Control Program (AWCP) CEQA Initial Study and Proposed Mitigated Negative Declaration*, Administrative Draft, Stockton, CA.
- Kipf, M.D. (2018). *Five Mile Slough Water Quality Evaluation Alexandria Place and Lincoln Road, Stockton, California, Condor Project No. 7677*, Condor Earth, Stockton, CA.
- Larry Walker Associates. (2009a). *City of Stockton & County of San Joaquin Final Stormwater Quality Control Criteria Plan*.
- Larry Walker Associates. (2009b). *City of Stockton National Pollutant Discharge Elimination System Municipal Stormwater Program Stormwater Management Plan*.
- Lewis, M. (2002). "Staff Report: Water Hyacinths in 5-Mile Slough." Letter to City of Stockton Mayor and City Council, City of Stockton, CA.
- Lincoln Unified School District. (2017). *Lincoln High School*, <<http://www.lincolnhigh.org/>>, (6 Oct. 2017).
- LSA Associates, Inc. (2016). *Addendum CEQA Initial Study/Mitigated Negative Declaration Hammer Lane Widening – Phase IIIB Project Stockton, CA*, Stockton, CA.
- Mark Thomas and Company. (2016). *Hammer Lane Widening Phase IIIB*, Improvement plans, Sacramento, CA.
- Moe, J. (1984). *Five Mile Creek Storm Study*, Stockton, CA.
- National Oceanic and Atmospheric Administration. (2017). "What is a Slough?" *National Ocean Service*, <<https://oceanservice.noaa.gov/facts/slough.html>>, (28 Nov. 2017).
- Pulver, J.W. (1998). "Five Mile Creek." Letter to Mr. Mark Madison of the City of Stockton Municipal Utilities Department, San Joaquin County Flood Control and Water Conservation District, Stockton, CA.
- R.W. Siegfried and Associates Civil Engineers. (1963). *John Breuner Company*, Improvement Plans, Stockton CA.
- R.W. Siegfried and Associates Consulting Civil Engineers. (1991). *Hammer Lane – El Dorado Street Storm Drain System*, Improvement Plans, Stockton, CA.
- R.W. Siegfried and Associates Consulting Civil Engineers. (1979). *Hammer Lane – Five Mile Creek Storm Drainage Basin Study*, Stockton, CA.
- R.W. Siegfried and Associates Consulting Civil Engineers. (1976). *Reclamation District 1608 Reconstruct Five Mile Slough Dam*, Improvement Plans, Stockton, CA.
- City of Stockton. (1957). *Plan and Profile for the Construction of an Earth Fill Across Five Mile Slough at Alexandria Place*, Improvement Plans, Stockton, CA.
- City of Stockton. (1987). *Plan and Profile for the Construction of an Earth Fill Across Five Mile Slough at Alexandria Place*, Improvement Plans, Stockton, CA.

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3244 Brookside Rd., #100 Stockton, CA 95219 t: 209.943.2021	111 N. Market St., #300 San Jose, CA 95113 t: 408.754.2021	109 Scripps Drive Sacramento, CA 95825 t: 916.520.2777	100 Sycamore Ave, #100 Modesto, CA 95354 t: 209.762.3580



- City of Stockton. (2017). "Swenson Park Golf Course in Stockton, California." *Stockton Golf Courses*, <<http://www.stocktongolfcourses.com/-swenson-park-gc>>, (10 Oct. 2017).
- Simpson, C. (2018). *Draft Environmental Report*, BaseCamp Environmental, Inc., Lodi, CA.
- Stovall, J.W. (2002). "Reclamation District 1608." Letter to V. Mow, San Joaquin County Board of Supervisors Chairman, Neumiller & Beardslee, Stockton, CA.
- U.S. Department of Agriculture Natural Resource Conservation Service (NRCS). (2017). *Web Soil Survey*, <<https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>>, (29 Nov. 2017).
- U.S. Geological Survey (USGS). (1898). *California Lodi Sheet*, 30 minute quadrangle.
- U.S. Geological Survey (USGS). (1910). *California (San Joaquin County) Castle Quadrangle*.
- U.S. Geological Survey (USGS). (1913). *California (San Joaquin County) Stockton Quadrangle*.
- U.S. Geological Survey (USGS). (1953). *Lodi South Quadrangle California—San Joaquin Co. 7.5 Minute Series (Topographic)*, Denver, CO.
- U.S. Geological Survey (USGS). (1952). *Stockton West Quadrangle California—San Joaquin Co. 7.5 Minute Series (Topographic)*, Denver, CO.
- U.S. Geological Survey (USGS) and California Department of Water Resources (DWR). (1968a). *Lodi South Quadrangle California—San Joaquin Co. 7.5 Minute Series (Topographic)*, Denver, CO.
- U.S. Geological Survey (USGS) and California Department of Water Resources (DWR). (1968b). *Stockton West Quadrangle California—San Joaquin Co. 7.5 Minute Series (Topographic)*, Denver, CO.
- U.S. Geological Survey (USGS) and California Department of Water Resources (DWR). (1976a). *Lodi South Quadrangle California—San Joaquin Co. 7.5 Minute Series (Topographic)*, Denver, CO.
- U.S. Geological Survey (USGS) and California Department of Water Resources (DWR). (1976b). *Stockton West Quadrangle California—San Joaquin Co. 7.5 Minute Series (Topographic)*, Denver, CO.
- U.S. Geological Survey (USGS). (2015a). *Lodi South Quadrangle California—San Joaquin Co. 7.5 Minute Series (Topographic)*, Denver, CO.
- U.S. Geological Survey (USGS). (2015b). *Stockton West Quadrangle California—San Joaquin Co. 7.5 Minute Series (Topographic)*, Denver, CO.
- U.S. Environmental Protection Agency (EPA). (2012). "2012 Waterbody Report for Five Mile Slough (Alexandria Place to Fourteen Mile Slough; in Delta Waterways, Eastern Portion)." *Water Quality Assessment and TMDL Information*, <[https://ofmpub.epa.gov/waters10/attains\\_index.home](https://ofmpub.epa.gov/waters10/attains_index.home)>, (6 Oct. 2017).
- U.S. Environmental Protection Agency (EPA). (2017). "Chlorpyrifos." *Ingredients Used in Pesticide Products*, <<https://www.epa.gov/ingredients-used-pesticide-products>>, (21 Nov. 2017).

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## **Exhibits**

Exhibit 1. Five Mile Slough and Five Mile Creek Watershed. This map shows the watershed area included in the scope of the study that drains into Five Mile Slough and Five Mile Creek upstream of Five Mile Dam, with major landmarks in the watershed identified. The approximate contours show the extent of flooding that would occur if Five Mile Dam were to be removed.

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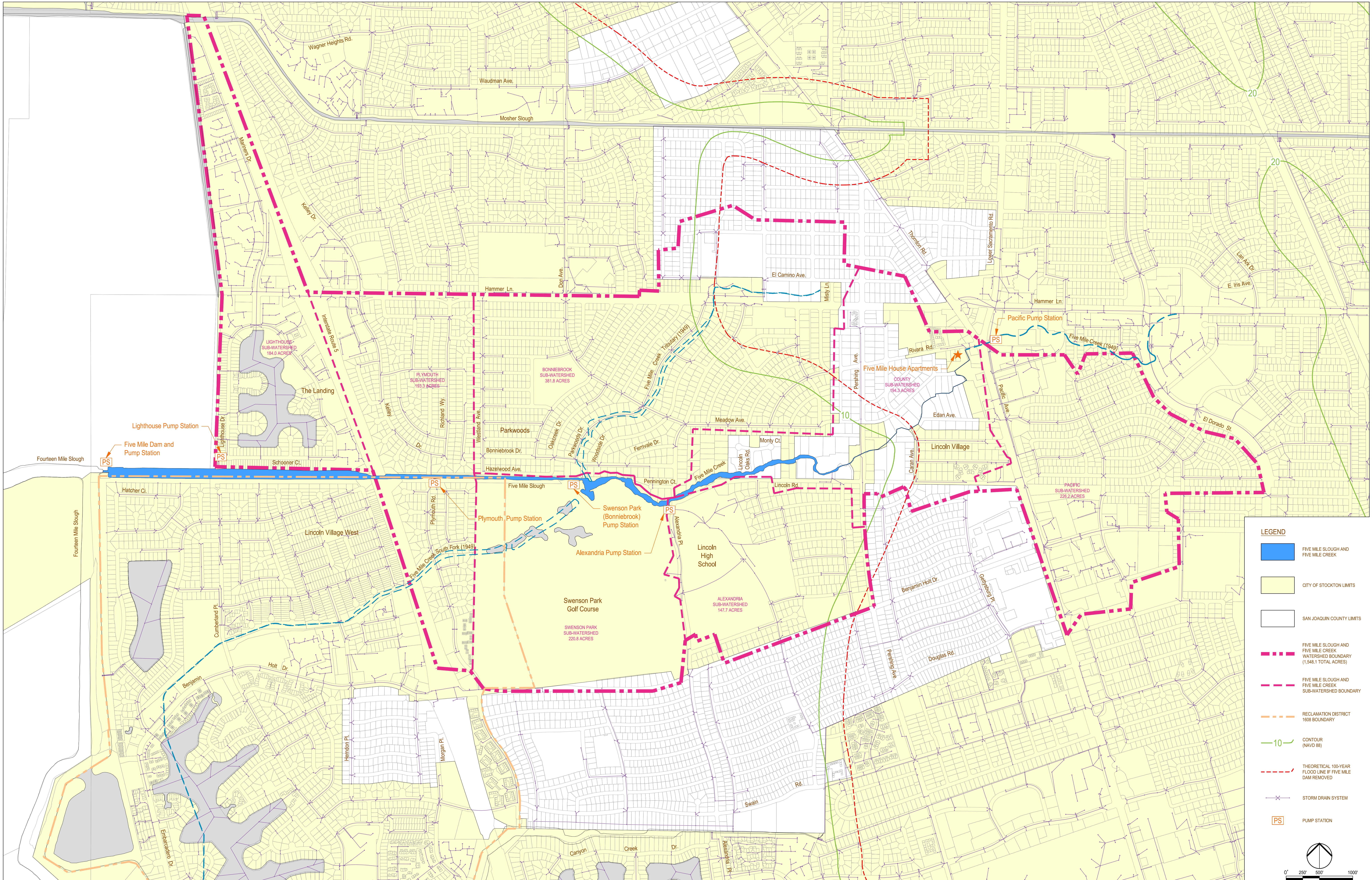
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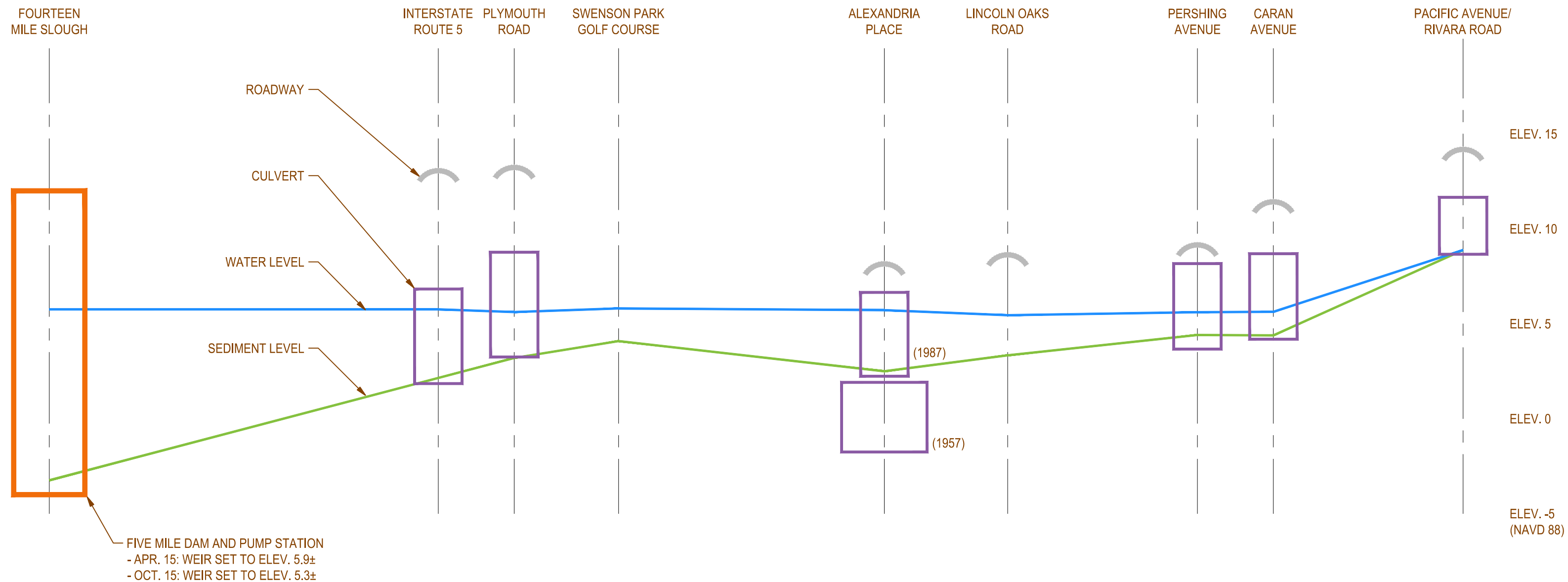
FIVE MILE SLOUGH AND FIVE MILE CREEK  
WATERSHED MAP OF FIVE MILE SLOUGH AND FIVE MILE CREEK  
Stockton, California

JULY 2018





Exhibit 2. Profile of Five Mile Slough and Five Mile Creek from Five Mile Dam to Pacific Avenue, based on topographic survey conducted in September 2017.



# FIVE MILE SLOUGH AND FIVE MILE CREEK

## SCHEMATIC PROFILE OF FIVE MILE SLOUGH AND FIVE MILE CREEK

Stockton, California



Exhibit 3. Friends of Five Mile Creek Steering Committee, Concerns Related to the Alexandria and Five Mile Slough Project Study Report

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<b>Stockton</b> 3244 Brookside Rd., #100 Stockton, CA 95219 t: 209.943.2021	<b>San Jose</b> 111 N. Market St., #300 San Jose, CA 95113 t: 408.754.2021	<b>Sacramento</b> 109 Scripps Drive Sacramento, CA 95825 t: 916.520.2777	<b>Modesto</b> 100 Sycamore Ave, #100 Modesto, CA 95354 t: 209.762.3580
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# ***Friends of Five Mile Creek Steering Committee***

## **Concerns Related to the “Alexandria and Five Mile Slough Project Study Report”**

- **4.3.1 History of Five Mile Creek**

- **Specific Concerns About the History of Five Mile Creek**

- The Project Study Report’s “History of Five Mile Creek” may not reference or use anecdotal evidence from long-time Stockton residents with first-hand knowledge of the history of Five Mile Creek.

- **4.3.2 Agency Responsibility or jurisdiction**

- **General Concerns about Agency Responsibility or Jurisdiction:**

- Because the City of Stockton and San Joaquin County are co-permittees for the “National Pollutant Discharge Elimination Permit” (NPDES) it is difficult to know which agency is responsible for each section of Stockton’s “Storm Water Management Plan.”
- Because Five Mile Creek runs through both the City of Stockton and San Joaquin County it is difficult for homeowners to distinguish each agency’s common responsibilities in different jurisdictions.

- **Specific Concerns about Agency Responsibility and Jurisdiction:**

- Which agency in each jurisdiction is responsible for obstructions to flow?
  - removing fallen trees?
  - removing beaver dams?
  - removing trash and debris?
  - removing aquatic weeds?
  - removing sediment?
- Which agency in each jurisdiction is responsible for the inspection, maintenance, and code compliance of man-made structures?
  - Alexandria Place pipe culvert?
  - Pershing Ave. bridge?
  - Caran Ave. box culvert?
  - Pacific Ave. box culvert?
  - Pacific Ave. pump station?
  - Alexandria Place pump station?
- Which agency in each jurisdiction is responsible for
  - testing water quality?
  - complying with state and federal water quality standards?
  - complying with state and federal water quality requirements?



- removing siltation caused by pump station discharges?
- removing aquatic weeds between the Swenson Golf Course and Hazelwood Ave.?
- removing aquatic weeds between Oak Creek Dr. and Alexandria Place?
- removing aquatic weeds between Alexandria Place and Pacific Ave.?
- removing aquatic weeds from the intake cove/bay at Swenson Golf Course?
- addressing water quality issues between Pacific Avenue and Alexandria Place?
- Which agency in each jurisdiction is responsible for “Post-Construction Storm Water Management” after the completion of the Hammer Lane Widening Project: (see May 26, 2017 letter from the Central Valley Regional Water Quality Control Board to the City of Stockton)
  - 1) “providing treatment BMPs to reduce pollutants in runoff,
  - 2) ensuring existing waters are not used as pollutant source controls and/or treatment controls,
  - 3) preserving and where possible, creating or restoring areas that provide important water quality benefits, such as riparian corridors, wetlands, and buffer zones,
  - 4) limiting disturbances of natural water bodies and natural drainage systems caused by development?”

#### • 4.3.3 Areas of Investigation

##### ○ Flow

##### ▪ Concerns about obstructions to flow

- Fallen trees
- Beaver dams
- Trash and debris
- Aquatic weeds
- Sediment
- Gas lines
- Corroded and deteriorated culverts
- Pipe culverts that impede the movement of aquatic weeds

##### ○ General Erosion along the creek

##### ▪ Concerns about general bank erosion along the creek

- Flow rates of storm water discharge may cause or contribute to downstream bank erosion.

##### ○ Water quality issues

##### ▪ Concerns about existing water quality issues

- **Concern:** Five Mile Creek is on the Environmental Protection Agency's 303(d) list of "impaired" waterways because the presence of pathogens, organophosphate pesticides (Chlorpyrifos and Diazinon), organic enrichment/low dissolved oxygen, and nutrients.
- **Concern:** Sanitary Sewer Overflows
- **Concern:** Trash and debris
- **Concern:** Aquatic weeds
- **Concern:** Implementation of Stockton's Storm Water Management Plan

- Responsible owners
- Possible solutions

#### • 4.3.4 Culvert at Alexandria

##### ○ History of Culvert

- **Concern:** The Alexandria culvert has a history blocking floating aquatic weeds (duckweed and azolla) from moving through the pipe culvert.
  - When the storm-water pumps discharge water at full capacity and the flow of the water in the creek is at its strongest, floating weeds are pushed downstream; however, most of the weeds are blocked at the Alexandria Place culvert.
    - As the water level increases past the diameter point of the culvert pipe, the horizontal surface area in the pipe decreases, preventing much of the floating weed mass from moving through the culvert.
    - When the pumps stop discharging, the water level drops, and the horizontal space in the pipe once again increases, but the force of the flow is now not strong enough to push the floating weeds through the pipe.
    - The trapped weeds create thick thermal mats, absorbing and trapping heat, increasing the water temperature, and decreasing dissolved oxygen levels.
    - Low dissolved oxygen has adverse impact on water quality in Five Mile Creek.
    - Low dissolved oxygen is also one of the "pollutants/stressor(s)" that caused Five Mile Creek to be included on 303(d) list of impaired waterbodies.

##### ○ Erosion issues at the roadway embankment and headwall

- **Concern:** Roadway erosion due to deteriorated headwall

- Adequate pipe size

- **Concern:** Making a determination on an adequate pipe size should factor in more than just moving water downstream to prevent flooding. Consideration should also be given to other storm water issues that the City of Stockton has identified.
  - **Low Dissolved Oxygen:** Stockton 'Storm Water Management Plan' identifies five possible causes of low dissolved oxygen, including "natural vegetation." (page 9-13 in the Storm Water Management Plan)
    - Floating aquatic weeds such as duckweed and azolla are forms of natural vegetation that contribute to the degraded water quality in Five-Mile Creek.
    - Consequently, moving floating natural vegetation downstream should also be considered when determining adequate pipe size.
  - **Enhanced Aesthetic Value:** The City of Stockton has identified "Enhanced Aesthetic Value" as a "benefit" of "implementing the provisions of the City of Stockton and County of San Joaquin MS4 National Pollutant Discharge Elimination System (NPDES) permit."
    - "Enhanced Aesthetic Value: Storm water affects the appearance and quality of a water body, and the desirability of working, living, traveling, or owning property near that water body. Reducing storm water pollution will increase benefits as these water bodies recover and become more desirable." (see "Fact Sheet City of Stockton and County of San Joaquin Storm Water Discharges from Municipal Separate Storm Sewer System" page 173)
    - Consequently, moving unsightly floating aquatic weeds downstream should also be considered when determining adequate pipe size.

- Alternatives other than a pipe

- Small Span Bridge

- 

- Box Culvert

- **Concern:** As the water level in the creek rises, the rectilinear structure of a box culvert will provide a consistent horizontal surface space for floating weeds to move through the culvert.



- Consequently, issues related to flood control, low dissolved oxygen, and enhanced aesthetic value will all be addressed in a significant and meaningful way.

- Permit/Environmental requirement for each alternative

- **4.3.5 Any erosion due to Alexandria pump station**

- existing conditions.
  - **Concern:** Loss of private property due to bank erosion
  - **Concern:** Deep depressions in the creek bed
  - **Concern:** Downstream bank erosion
- solutions

- **4.3.6 Sediment source and sedimentation issues near the pump station outfall and East of the Alexandria Culvert**

- **Concern:** The high level of sediment could cause flooding.
- **Concern:** The high level of sediment degrades water quality
  - Warmer water temperature
  - Rapid growth of aquatic weeds
- **Concern:** The high level of sediment may clog any new culvert.

- **4.3.7 Friends of Five Mile Creek Concern Matrix**

- Permitting
- Design and construction
- Financial responsibility for each agency.

- **4.3.8 Cost Estimate**

## **Sources of Information**

1. To locate the City of Stockton's "Stormwater Management Plan," Google "Stormwater – City of Stockton, Ca," and open the link to "Stormwater Management Plan."
2. To locate the May 26, 2017 letter from the Central Valley Regional Water Quality Control Board to the City of Stockton, Google "26 May 2017 Rosa Alvarez City of Stockton." The information referenced is on page 13 of 16.
3. The information from the "Fact Sheet City of Stockton and County of San Joaquin Storm Water Discharges from Municipal Separate Storm Sewer System" is attached to this document.



CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD  
CENTRAL VALLEY REGION

ORDER NO. R5-2007-0173

NPDES NO. CAS083470

**FACT SHEET**

CITY OF STOCKTON  
AND  
COUNTY OF SAN JOAQUIN  
STORM WATER DISCHARGES FROM  
MUNICIPAL SEPARATE STORM SEWER SYSTEM  
SAN JOAQUIN COUNTY

**I. PURPOSE**

The Regional Water Quality Control Board, Central Valley Region (Regional Water Board) will be considering adoption of a renewal of the City of Stockton and County of San Joaquin's Municipal Separate Storm Sewer System NPDES Permit. The purpose of this Fact Sheet is to provide the Permittees and interested persons an overview of the proposed permit and to provide the technical basis for the permit requirements. Sections I through IV describe water quality problems from storm water and urban runoff, and permit conditions designed to address these problems. Sections V and VI discuss each major element of the Permittees' Storm Water Management Plan (SWMP), that will be adopted by the Regional Water Board and is considered an integral and enforceable component of the proposed permit.

The proposed permit specifies requirements necessary for the Permittees to reduce the discharge of pollutants in urban runoff to the maximum extent practicable (MEP). However, since compliance with the MEP standard is an iterative process, the Permittees' storm water programs must continually be assessed and modified as urban runoff management knowledge increases, to incorporate improved programs, control measures, best management practices (BMPs), etc. in order to achieve the MEP standard. This continual assessment, revision, and improvement of storm water management program implementation is expected to achieve compliance with water quality standards.

## II. THE NEED TO REGULATE STORM WATER DISCHARGES

### A. Impacts

The quality of storm water and urban runoff are fundamentally important to the health of the environment and the quality of life in the Central Valley Region. Polluted storm water runoff is a leading cause of water quality impairment in the Stockton-San Joaquin-Delta Area, as well as other potential sources as aerial deposition and runoff from agricultural areas upstream of the Stockton urbanized area. Storm water and urban runoff (during dry and wet weather) are often polluted with pesticides, fertilizers, animal droppings, food wastes, automotive byproducts, and many other toxic substances generated by urban environments. Water that flows over streets, parking lots, construction sites, and industrial, commercial, residential, and municipal areas carries these pollutants through the storm drain systems directly into the receiving waters of the Stockton-San Joaquin-Delta Area. The water quality impacts and increased public health risks from municipal separate storm sewer system (MS4) discharges that affect receiving waters nationwide and in the Central Valley Region are well documented.

The **National Urban Runoff Program (NURP)** Study [U.S. Environmental Protection Agency (U.S. EPA) 1983] showed that MS4 discharges draining from residential, commercial, and light industrial areas contain significant loadings of total suspended solids. Although the NURP Study did not cover industrial sites, the study suggested that runoff from industrial sites may have significantly higher contaminant levels than runoff from other urban land use sites. Several studies tend to support this observation. For example, in Fresno, a NURP project site, industrial areas had the poorest storm water quality of the four land uses evaluated. The study found that pollutant levels from illicit discharges were high enough to significantly degrade receiving water quality, and threaten aquatic life, wildlife, and human health.

The 1992, 1994, and 1996 National Water Quality Inventory Reports to Congress prepared by the U.S. Environmental Protection Agency (U.S. EPA) showed a trend of impairment in the nation's waters from contaminated storm water and urban runoff. The 1998 National Water Quality Inventory [305(b) Report]<sup>1</sup> showed that urban runoff/storm water discharges affect 11% of rivers, 12% of lakes, and 28% of estuaries. The report notes that urban runoff and storm water discharges are the leading

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<sup>1</sup> *Quality of Our Nation's Waters: Summary of the National Water Quality Inventory 1998 Report to Congress* - U.S. EPA 841-S-00-001 - June 2000; *Water Quality Conditions in the United States: Profile from the 1998 National Water Quality Inventory Report to Congress* - U.S. EPA 841-F-00-006 - June 2000

source of pollution and the main factor in the degradation of surface water quality<sup>2</sup> in California's rivers and streams.

The Natural Resources Defense Council (NRDC) 1999 report, *Stormwater Strategies, Community Responses to Runoff Pollution*<sup>3</sup> identifies two main causes of the storm water pollution problem in urban areas. Both causes are directly related to development in urban and urbanizing areas:

1. Increased volume and velocity of surface runoff. There are three types of human-made impervious covers that increase the volume and velocity of runoff: (i) rooftop, (ii) transportation imperviousness, and (iii) non-porous (impervious) surfaces. As these impervious surfaces increase, infiltration will decrease, forcing more water to run off the surface, picking up speed and pollutants.
2. The concentration of pollutants in the runoff. Certain activities, such as those from industrial sites, are large contributors of pollutant concentrations to the storm water system.

The report also identified several activities causing storm water pollution from urban areas, practices of homeowners, businesses, and government agencies.

#### B. Benefits of Permit Program Implementation

Implementation of Best Management Practices (BMPs) should reduce pollutant discharges, and improve surface water quality. The expected benefits of implementing the provisions of the City of Stockton and County of San Joaquin MS4 National Pollutant Discharge Elimination System (NPDES) permit include:

1. **Enhanced Aesthetic Value:** Storm water affects the appearance and quality of a water body, and the desirability of working, living, traveling, or owning property near that water body. Reducing storm water pollution will increase benefits as these water bodies recover and become more desirable.
2. **Enhanced Opportunities for Boating:** reducing sediment and other pollutants, and increasing water clarity, which enhances the boating experience for users, offer additional benefits.

<sup>2</sup> *Quality of Our Nation's Waters: Summary of the National Water Quality Inventory 1998 Report to Congress* – U.S. EPA 841-S-00-001, June 2000.

<sup>3</sup> *Clean Water & Oceans: Water Pollution: In Depth Report Stormwater Strategies, Community Responses to Runoff Pollution.* Natural Resources Defense Council (NRDC), 1999.